

**Claims**

What is claimed is:

- 1 1. An apparatus that provides at least one estimated effective age of a  
2 product, comprising:  
3 at least one sensor that provides data about an environmental  
4 condition;  
5 a device that uses said data to calculate an age acceleration  
6 factor for said product for at least one of said sensors;  
7 at least one accumulator that provides the estimated effective  
8 age for said product, based upon said age acceleration factor; and  
9 a display capable of presenting said estimated effective age to  
10 a user of said product.
- 1 2. The apparatus of claim 1, wherein said sensor includes an analog to  
2 digital conversion function, and wherein said device that uses said  
3 data to calculate an age acceleration factor is a digital processor.
- 1 3. The apparatus of claim 2, wherein said digital processor is  
2 programmed to compute an Arrhenius estimate of said age  
3 acceleration.
- 1 4. The apparatus of claim 2, wherein said digital processor is  
2 programmed to compute a Coffin-Manson estimate of age  
3 acceleration.
- 1 5. The apparatus of claim 2, wherein said digital processor is  
2 programmed to compute a Hallberg-Peck estimate of age  
3 acceleration.

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- 1 6. The apparatus of claim 2, wherein said accumulator is at least  
2 partially implemented in nonvolatile storage .
- 1 7. The apparatus of claim 6, wherein said nonvolatile storage is a  
2 ferroelectric memory.
- 1 8. The apparatus of claim 6, wherein said nonvolatile storage is a flash  
2 memory.
- 1 9. The apparatus of claim 6, wherein said nonvolatile storage is a hard  
2 disk.
- 1 10. The apparatus of claim 6, wherein said nonvolatile storage is a  
2 volatile memory element, with continuity of power provided by a  
3 battery.
- 1 11. The apparatus of claim 1, wherein said sensor produces an analog  
2 voltage output, said analog voltage output varying substantially  
3 linearly responsive to a change in temperature.
- 1 12. The apparatus of claim 11, wherein said device that uses said data to  
2 calculate an age acceleration factor for said product is a VCO, said  
3 VCO producing a VCO output signal that varies substantially  
4 exponentially responsive to a linear voltage change on an input of the  
5 VCO.
- 1 13. The apparatus of claim 12, wherein said accumulator is a counter;  
2 said counter being implemented, at least in part, in a nonvolatile or  
3 effectively nonvolatile technology.
- 1 14. The apparatus of claim 13, wherein said display is electrically  
2 coupled to selected bits of said counter.

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1 15. A method for producing one or more estimates of effective age of a  
2 product, comprising the steps of:

3 sensing one or more environmental conditions;

4 computing an age acceleration factor for each of the  
5 environmental conditions sensed, using a model that relates the  
6 environmental condition to the age acceleration factor;

7 computing effective age values, using said acceleration  
8 factors;

9 storing said effective age values into nonvolatile storage; and

10 displaying said effective age values to a user of said product  
11 on a display.

1 16. The method of claim 15, wherein the step of computing an age  
2 acceleration factor comprises the use of the Arrhenius equation, the  
3 Hallberg-Peck equation, or the Coffin-Manson equation.

1 17. The method of claim 15, wherein the step of computing effective age  
2 values further comprises the steps of:

3 time integrating the age acceleration factor for each of the  
4 environmental conditions sensed, resulting in an effective age for the  
5 product according to each said model;

6 computing a normalized effective age for some or all of the  
7 effective ages by dividing the instant effective age by a wall clock  
8 age;

9 computing an effective life used value for some or all of the  
10 effective ages by dividing the instant effective age by a  
11 predetermined estimate of life of the product; and

12                    computing an effective life remaining value for some or all of  
13                    the effective ages by subtracting said effective life used value from  
14                    "1".

1                    18. The method of claim 15, wherein the step of displaying said effective  
2                    age values further comprises the steps of:

3                    determining if any of said values are outside of predetermined  
4                    ranges; and

5                    alerting the user if any of said values are outside of  
6                    predetermined ranges by lighting a light, sounding an audible alarm, or  
7                    presenting said values on said display